

THE AMERICAN JOURNAL  
OF  
**OPHTHALMOLOGY**

---

VOL. XXIX.

OCTOBER, 1912.

No. 10

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**ORIGINAL ARTICLES.**

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**USEFULNESS OF THE SCHIÖTZ TONOMETER.\***

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Any instrument that enables the clinician to obtain a more accurate knowledge of the disease he is called on to treat is a welcome addition to his armamentarium, especially if its application is simple, and the resulting observations can be accurately recorded.

After considerable experience with the Schiötz tonometer in the measurement of intraocular tension, I believe that it fully meets the above conditions. I am fully in accord with the statement of A. Greene, that in clinical ophthalmology this instrument is as much superior to the touch as is the clinical thermometer for the general practitioner.

My purpose in presenting this demonstration with clinical reports is not to draw conclusions regarding the advantages of certain methods in the surgical treatment of glaucoma, nor to make rules for the choice between medical and surgical treatment. A much greater quantity and variety of clinical observations in glaucoma than are at my disposal at present would be desirable for such a report. However, emphasis can be laid on the general usefulness and availability of accurate tonometry in making clinical observations.

Already quite a volume of contributions has been made to

\*Read at the meeting of the Medical Association of the Southwest, Hot Springs, Ark., October 9, 1912.

ophthalmological literature on this subject. It is not proper to take your time to enumerate all the investigators and their reports when there is an excellent Year Book, founded by Dr. Edw. Jackson of Denver, nine years ago, which is or ought to be in the ready reference library of every American ophthalmologist, which treats this subject fully.

The Schiötz instrument was offered to ophthalmologists by Prof. Schiötz of Christiania, Norway, after careful tests extending throughout several years. These were repeated to insure its accuracy and to prepare for the interpretation of the readings on the scale of the instrument—a table so comprehensive as to remove any hindrance to its most extensive use in clinical ophthalmology.

In using the instrument the base, with its slightly concave under surface, is placed on the center of the cornea of the eye to be examined, the patient lying prone so that the instrument is placed vertically. Of course the eye is anaesthetized for this procedure. A solution of holocain 1 or 2 per cent. is generally employed, because it has little if any effect on the tension, size of the pupil, or accommodation; nor does it have any but a beneficial effect on the corneal epithelium. In my own experience the use of cocaine (4 per cent. solution) in eyes previously tested under holocain (1 per cent. solution) produced no change in the measurements. I shall, however, continue to prefer holocain because of the other advantages just noted.

The instrument is steadied by the handles, which are attached to a collar sliding upon a tube which extends upward about one inch from the base, base and tubing being of one piece of metal. The sliding collar has six roller bearings to prevent any effect on the readings by direct contact between the cylinders of the tube and collar. At the top of the tube the latter is surmounted by a ring which carries the stem supporting the scale which indicates the number of millimeters which the plunger depresses the cornea.

A moveable indicator moves in front of the scale resting on the plunger of the arm to the right of the pivot. The fixation screw is an important little thing often unnoticed. It fixes the connection between the tube below and the scale above. Any slipping or displacement here by changing the distance between the scale and the base affects the value of the reading; therefore it should be inspected occasionally, for otherwise errors may creep in unnoticed and confuse the results. The purpose of this

joint, which is dependent on so frail a screw to hold its position absolutely true, is to enable the user to keep his instrument so corrected that all readings will be made from the zero point on the scale at Z. This correction is made by the aid of a convex cap, approximating, but in reality less convex than the average cornea, and exactly corresponding to the concavity in the base of the instrument. When the instrument is placed on this cap with the plunger in position, the indicator should rest at zero. In making the measurement the plunger carries one of the four weights furnished with the instrument.

If the lowest one of these, a 5.5 gram weight, does not depress the globe beyond the level of the concavity of the base because of the high pressure within, the reading will stop at zero. If the tension is very high, it may be that the plunger will be raised up; in that event there will be a negative reading. No provision is made for recording these. When a definite reading anywhere between 1 and 10 is secured, it is usually superfluous, and often undesirable to make other readings with heavier weights. Heavier weights, by deeply indenting the cornea at the point of contact with the plunger, change the relations between the base and the cornea so that error and conflicting results may occur. The possibility of injury to the corneal epithelium is so remote even with the largest weights that this need hardly influence the choice of the lighter ones.

Of much importance is the placing of the base exactly over the center of the cornea with the instrument in the vertical position. In order that this may be done with as nearly perfect accuracy as possible, I prefer to give my personal attention to the position of the base, relying on the observation of an assistant to get the readings of the scale. The latter is really a very simple matter which a nurse, or any office assistant can do after a single experience. It can always be controlled by side glances from the operator himself. These are in most cases sufficient, as the instrument is often used by one man alone. However, in such cases it is well to watch for variations in the indicator, sometimes of considerable degree, due to rolling of the globe by the patient. As the patient shifts the globe the base of the instrument comes to rest on the limbus and sclera, the convexity of which shows so much irregularity that no value can be placed on the measurements thus obtained. Some have tried to equalize results by making a number of measurements at the same time and then averaging the results. It seems to me this is a method

that is likely to make error seem legitimate when it has been averaged with other more correct readings. I have tried out the value of the averaging process again and again. Measurements made repeatedly on the same case at the same time have shown that when the instrument was accurately placed each time there was not more than a negligible difference of one or two points and usually no difference at all. Whenever there appeared to be a marked variation, I invariably found there was a reason for it which usually could be attributed to an error in the technique rather than to an actual change in the tension of the globe.

In this connection it is well to recall the tests made by Polak von Gelder, which show sudden rise in intraocular tension caused by blepharospasm on the introduction of various types of lid retractors and specula. It seems to me therefore quite conclusive that averages obtained by combining widely different readings are incorrect on their face.

A unique possible cause of error was suggested by Paul Knapp, Switzerland, namely, that the pressure of much moisture in the conjunctival sac might produce a change in the position of the plunger by capillary attraction. I have used before each application of the instrument a droplet of oil (albolene) on the tip of the plunger to protect the epithelium. Perhaps it also prevented the action of capillary attraction.

The continuous application of the instrument to the eye is followed by a reduction in the tension which is more noticeable in normal eyes than those diseased by glaucoma, showing more active filtration in the former. The immediate measurement indicated by the tonometer is therefore the most trustworthy. (Schiötz, Stock, Langenhan and Polak von Gelder).

Paul Knapp, of Basel, Switzerland, after a long series of carefully conducted experiments controlled by measurements with the Schiötz Tonometer, finds a positive reduction of the tension of the globe after massage of the globe for several minutes, with a return to the previous tension about 45 minutes later. In acute glaucoma he found no benefit from massage; but in simple chronic cases, and after operation, a large proportion seemed to be benefitted by massage.

It seems to stand as an approved fact that the normal ocular tension may be anything from 12 to 26 m.m. There may be some few individuals with eyes in apparently normal condition by all other tests who may show as low a tension as 8 or 10 m.m., and perhaps some eyes may measure as high as 28 or 30 m.m.,

and yet be found normal by all other tests. Of the latter I am very doubtful. However, as Stock says, if an eye has normal tension of 12 m.m. and then rises to 20 m.m., we must look on this as a pathological manifestation, and must therefore be on the lookout for cases of glaucoma with "normal" tension even now when we possess a much more accurate means of measuring that tension. It is therefore of importance that other tests, such as the accurate measurement of vision, the frequent taking of visual fields, ophthalmoscopic examinations and the careful notation of all other clinical signs, should not be neglected or this instrument substituted for them. They should all be used together in diagnosis and prognosis. That the diagnosis is made easier is incontrovertible, as is also the fact that the effect of treatment, medical or surgical, can be much more closely watched by the aid of the tonometer. No rule for relation between age and intraocular tension can be determined.

Clinical records are of greater interest in this connection than abstract deductions. In the remainder of this paper therefore I shall refer to selected cases, as briefly as possible, in the discussion of the usefulness of this instrument.

#### GLAUCOMA WITH TENSION WITHIN NORMAL LIMITS.

*Case 1.*—Sept. 29, 1911.—Mrs. C. E., age 50. Patient had been seen twice before in the previous two and one-half years for the adjustment of glasses on account hypermetropia and presbyopia. Correction of these defects had rendered the patient comfortable. She now complained of "neuralgia" and "poor sight". Tests showed central vision but slightly involved when the hypermetropia was fully corrected. The fields, however, showed marked contraction, especially that of the *right eye*. Tonometer: O.D., 17 m.m.; O.S., 15 m.m. One-half per cent. pilocarpin solution was ordered t.i.d. and glasses adjusted.

Three weeks later the fields were normal, right and left. Two months later, was "sick in bed" with another attack of neuralgia; chiefly occipital this time. Ocular examination revealed nothing to account for it. Advised to see a rhinologist. Had no time for this.

March 9th, 1912, or five months after the first attack above recorded, returned saying she had been doing well until she took "cold". Since then, neuralgic pains had returned. Tonometer readings: O.D., 16 mm.; O.S. 17.5 m.m. Fields practically normal. Central vision slightly disturbed. Rhinological examina-

tion showed boggy middle turbinates impinging on septum right and left.

A month latter, after treatment by Dr. F. C. Simon for the nasal condition. Tonometer: O.D. and O.S., 14 m.m.

Seven months later (Oct. 2, 1912) she returned with the report that she is now doing entirely well, her head being free from all former disturbances. Central vision perfect. Tonometer: O.D. and O.S., 13 m.m. Patient continues to use pilocarpin solution ( $\frac{1}{2}$  per cent.) in each eye, night and morning.

To the significance of nasal disturbances in patients suffering from glaucoma, I shall refer later. It seems evident we were here dealing with hypertension for this individual. At the same time the highest mark reached is well within average normal limits. It is beyond the possibilities by the touch of the finger, to have detected variations as slight as above noted, or to have recorded them so accurately as to refer to the record more than a year later for comparison.

*Case 2.*—W. H. M., age 52. First seen on November 15, 1911. Spells of pain in head. Blurred vision. Left pupil larger than right. Occasional halo around lights. O.D., V 16/12; O.S., V 16/38, either with+.5 Sph.

One brother blind at fifty from "hardening of eye". Ophthalmoscopic examination revealed nothing pathological. Tonometer: O.D. and O.S., 14 m.m. Fields practically normal. Prescribed pilocarpin solution  $\frac{1}{2}$  per cent. (in oil) t.i.d. right and left.

November 21st, six days later: O.D., V 16/8; O.S. V 16/19, either with+.5 Sph. Tonometer: O.D., 13 m.m.; O.S., 11 m.m.

December 2nd. Tonometer: O.D., 14 m.m.; O.S., 21 m.m. O.D., V 16/12; O.S., V 16/38, either with +.5 Sph.

Notice a drop of visual acuity corresponding to the increase of intraocular tension of the left eye. On account of this variability in the tension, other observations being made between the dates here recorded, the patient was now put on eserin (salicyl) solution 1/480 (in oil).

March 7th (5th month): O.D. and O.S., 12 m.m. O.D., V 16/12; O.S., V 16/19, either with+.5 Sph. B.P.—125.

May 20th (7th month): No change.

July 22nd (8th month): No change.

September 16th (10th month): Tonometer: O.D. and O.S. 13 m.m. O.D., V 16/10; O.S., V 16/12, either with+.75 Sph. Fields remain normal. Note continuous improvement in vision

O.S. Is using eserin salicylate 1/480 (in oil) daily in each eye.

While pilocarpin is borne better by many cases, I do not believe we can depend on it as we can on eserin. I have not discontinued the use of pilocarpin in selected cases of mild glaucoma, but never depend on it without careful control. Dr. John Green probably placed the correct estimate on the efficiency of pilocarpin when he said that to use it in lieu of eserin is "sending the boy to the mill".

Great satisfaction in the clinical use of this instrument comes in the ordinary cases of glaucoma, of which there are enough in the practice of every ophthalmologist to disturb his self-confidence and piece of mind.

I recall the remark of a well-known ophthalmologist some years ago, that he dreaded the outcome with each case of glaucoma so much that he almost wished they would all go to see "the other fellow". No matter what therapeutic course we pursue in a given case, in the rise or fall of the intraocular tension—even those slight changes which escape the most skilled sense of touch—the tonometer will give a control of the case not to be had without it.

Let us take, then, the record of a case of simple chronic glaucoma just to show how these measurements vary in the course of a year's observation.

It is gratifying to know that the tension has been reduced to "normal" limits, which is about all that could be expected from any line of treatment. Operative interference was excluded anyway in this case and offered but little hope at best. When first seen this patient's visual fields did not extend more than 10° from the line of fixation.

#### SIMPLE CHRONIC GLAUCOMA.

Mrs. A. L., aged 63. Sight gradually "worse". Ophthalmoscope: Deep glaucomatous cupping at discs. O.D., V 16/15; O.S., V 16/21, either with correction.

Tonometer: November 16, 1911: O.D., 43 m.m.; O.S., 36 m.m.

17th.—O.D. and O.S., 33 m.m.

20th.—O.D., 39 m.m.; O.S., 37 m.m.

23rd.—O.D., 26 m.m.; O.S., 24 m.m.

December 8th.—O.D., 23 m.m.; O.S., 36 m.m.

21st.—O.D., 29 m.m.; O.S., 36 m.m.

January 19th.—O.D., 35 m.m.; O.S., 33 m.m.

February 8.—O.D., 26 m.m.; O.S., 24 m.m.

March 1st.—O.D., 36 m.m.; O.S., 26 m.m.

March 15th.—O.D., 27 m.m.; O.S., 23 m.m. Blood pressure 190.

April 19th.—O.D., 33 m.m.; O.S., 25 m.m. Blood pressure 170. No improvement in the intraocular tension with the reduction of the general blood pressure.

May 24th.—O.D., 33 m.m.; O.S., 24 m.m.

June 22nd.—O.D., 21 m.m.; O.S., 18 m.m.

July 10th.—O.D., 23 m.m.; O.S., 25 m.m.

August 27th.—O.D., 30 m.m.; O.S., 17 m.m.

September 26th.—O.D., 21 m.m.; O.S., 18 m.m. (Uses eserin solution 1/240, oil, N&M). O.D., V 16/15; O.S., V 16/21, either with correction.

Similarly, in the following case, an eye, the sight of which had been destroyed and which had become a source of much suffering, showed reduction in the tension with corresponding freedom from pain, while the second eye was checked in an incipient glaucoma and prompt control of its reaction to treatment was possible.

#### CHRONIC GLAUCOMA BECOMING "INFLAMMATORY".

J. H. J., age 66; seen first time May 7, 1912. O.D., "troublesome" and "blind" for ten years, but more painful in last two months. O.S., no complaint.

Examination showed: O.D., no perception of light, cornea steamy, globe injected, hard to touch; pupil dilated; ophthalmoscope gives no red reflection. O.S., with +1.5 Sph., V 16/15. Field of vision slightly contracted.

Tonometer: O.D., too great for measurement with 15 grammes weight; O.S., 37 m.m.

O.D., used eserin  $\frac{1}{2}$  per cent. (in oil); O.S., pilocarpin 1 per cent. (in oil) after which O.D., 123 m.m.; O.S., 23 m.m. Partial myosis O.D.; good myosis O.S.

Ordered eserin solution  $\frac{1}{2}$  per cent. (in oil) used every three hours O.D. May 18, 1912 (following day), O.D., 112 m.m., and patient almost free from pain; O.S., 40 m.m., showing that the action of the pilocarpin had been quite transitory. Ordered eserin solution  $\frac{1}{2}$  per cent. to be used as before O.D., also night and morning O.S.

August 10, 1912, O.D., 112 m.m.; O.S., 31 m.m. Field O.S. much larger.

August 21, 1912, O.D., 90 m.m.; O.S., 31 m.m.

This case has been under constant observation and doing well both subjectively and objectively as the following test shows:

October 4, 1912, O.D., 83 m.m.; O.S., 19 m.m. O.S. with correction 16/12+.

Tests were made in this case to determine the advantage, if any, of the oily solutions over watery solutions of miotics. They are not conclusive, but seem to be in favor of the solutions in oil.

September 20, 1912, O.D., 83 m.m.; 10:30 a.m., O.S., 23 m.m.

Used aq. solution of eserin 1/240 fresh. One hour later O.D., 97 m.m.; O.S. 14 m.m. Two hours later, O.D., 85 m.m.; O.S., 16 m.m.

Used eserin solution (in oil) 1/240 old. One hour later, O.D., 97 m.m.; O.S., 12 m.m.

September 26, 1912, 10 a.m., O.D., 85 m.m.; O.S., 22 m.m.

Used eserin salicylate (in oil) 1/240 Rth. One hour later, O.D., 97 m.m.; O.S., 12 m.m. Three hours later, O.D., 97 m.m.; O.S., 17 m.m.

After many clinical observations, it has long been my conviction that solutions in oil, both of atropin and eserin, have more lasting effects than watery solutions of the same strength. They possess the advantages of slight constitutional effects even when used frequently because they do not pass to the nose, as do aqueous solutions, and become absorbed by the Schneiderian membrane.

This test shows they are more than equal both in promptness and degree of effect. Besides the aqueous solution was fresh while the oily solution was taken from a vial in regular use for several months.

The results in the right eye may be disregarded in this connection. Undoubtedly its variable reaction is due to secondary changes which produce uncertainties in the response to drugs, which will be referred to again in considering secondary glaucoma.

In some trials with the left eye the lowest weight, 5.5 grammes, did not register although tests by the 7.5 grammes showed very moderate normal pressure. Probably sclerotic changes in the cornea afford the explanation, no depression being made by the lighter weight, but once the resistance of the tissue itself being overcome by a slightly greater weight the intraocular tension is found normal.

Before leaving this subject of idiopathic glaucoma, I wish to refer to an observation by Dr. A. E. Ewing, published in the AMERICAN JOURNAL OF OPHTHALMOLOGY, December, 1908, entitled "Pain of Acute Glaucoma relieved by Cocain applied to Meckel's Ganglion," on account of the possible aetiological importance of diseases of the nasal cavity and accessory sinuses in glaucoma. I believe his was the first report to call attention to this relation.

Several times my own experience has confirmed Dr. Ewing's observation; but the following is the first case in which the subjective improvement was shown by tonometric measurements to be accompanied by marked diminution of intraocular tension. In a second case, the result was different, though twice tested, showing that this is not a constant factor in glaucomatous pain.

It may be, as Dr. Sluder points out in the description of the rhinological technique in Ewing's paper, that anatomic variations prevented perfect anaesthesia of the ganglion in this second case.

In a third case, where the tension was watched during the use of atropin for the measurement of the refraction, a slight rise in the tension could be noted after the application of cocain to the ganglion on one side. However, the fact that the ganglion had been reached seemed demonstrated by the complete relief from a severe neuralgic pain in the head which had existed for days before and had not yielded to atropin.

#### INTRAOCULAR TENSION IN GLAUCOMA REDUCED BY ANAESTHESIA OF MECKEL'S GANGLION.

Mrs. T. T., age 56. August 23, 1912.—Eight years ago failure in sight began in O.D., later O.S. also involved. Treated at the O'Fallon Dispensary (Medical Department of Washington University). Miotics seemed to give excellent control as determined by central vision and fields.

We were then using eserin at the clinic and she was using pilocarpin at home. She disappeared for over three years, during which time she moved about the country. Was treated a short time only at Johns Hopkins Medical School. Most of the time she was without supervision, living on a farm.

Her present condition shows O.D., no perception of light (five years ago vision was 4/75). O.S., V 4/150 (formerly was 20/19). Used eserin 1/240.

August 24, 1912.—Much more comfortable after eserin used

yesterday. O.S., V 5/75. Tonometer: O.D., 51 m.m.; O.S., 36 m.m.

Used eserin salicylate 1/240 (in oil). After one hour full miosis. O.D., 30 m.m.; O.S., 18 m.m. Blood pressure 165.

August 27, 1912 (three days later), "caught cold last night". Pain in head and blurring of vision worse to-day. Tonometer: O.D., 60 m.m.; O.S., 51 m.m.

Without the use of any miotic, patient was referred to Dr. H. Edw. Miller for rhinological examination. He reported severe suppurative pan-sinusitis—right and left—and used cocaine freely to shrink the swollen membrane. Three-quarters hour later, without further ocular treatment, tonometer: O.D., 55 m.m.; O.S., 37 m.m.

Treatment of the nasal condition as well as the use of miotics could only be continued for two or three days as the patient was compelled to return to her home. She was subjectively much better—almost free from pain and sight "clearer". In the first few days she required an attendant to bring her; now she was able to get about the city alone.

Intraocular tension when last seen was O.D., 32 m.m.; O.S., 26 m.m. She was ordered to use eserine salicylate ( $\frac{1}{2}$  per cent.) (in oil) in each eye, night and morning.

Mrs. H. K., age 68.—August 29, 1912—occasional pain in left side of head for a year. Three weeks ago sudden attack came in right eye which has not ceased. O.D., pupil dilated, lens cataractous. No pupillary response to light, tension plus, vision acute. O.S., giving no trouble, pupil responds promptly, vision with plus 3 spherical 16/15. Tonometer shows O.D. 70 m.m.

Examination by Dr. H. E. Miller shows middle meatus of nose almost closed with swelling, some purulent secretion on left side, anaesthesia of ganglion on right side. Three-quarters hour later, tonometer: O.D., 73 m.m. Used eserin  $\frac{1}{2}$  per cent. and prescribed eserin  $\frac{1}{2}$  per cent. (in oil) every four hours, as well as general treatment.

August 30, 1912 (following day)—Tonometer: O.D., 44 m.m.; O.S., 15 m.m. After applications to the nose by Dr. Miller, O.D., 44 m.m.

September 6, 1912—O.D., 51 m.m.

September 10, 1912—O.D., 55 m.m.; O.S., 13 m.m. Patient refused to have operation done on the O.D. and disappears, promising to return in one week, which she did not do.

Mrs. J. B. B., age 51.—September 16, 1912.—O.D., Em.(?) V

16/12; O.S., Ah. .75 Mo.+60° V 16/12. Blood pressure 125. Tonometer: O.D., O.S., 18 m.m. Used homatropin 2 per cent. right and left. One hour later full dilatation. O.D., O.S., 18 m.m. Used atropin with cocaine. One hour later, O.D., O.S., 19 m.m.

September 17, 1912 (following day)—O.D., 17 m.m.; O.S., 15 m.m. Right Meckel's ganglion anæsthetized, after which O.D., 18 m.m.; O.S., 17 m.m.

It seems to me we must regard the rise of tension in the second and third cases almost as significant as the pronounced diminution in the degree of tension present in the first case following the application of cocaine to the region of Meckel's ganglion. They both signify that certain nasal conditions may be, in a manner not yet understood, factors in the production of idiopathic glaucoma.

The following case, showing rather striking variation both in vision and in intraocular pressure, is mentioned in this connection for the reason that the patient was suffering at the same time from enlargement of the turbinates, for which Dr. Sluder urged operative interference, which was refused at the time because the patient first wished to go home to consult her parents. During the time that she was at home for her Christmas holidays, some operative treatment for her nose was undertaken by a physician in her home town, and her father wrote me that she was doing entirely well since it had been accomplished; that her eyes gave her no further trouble either. This is not first class evidence, but is nevertheless suggestive.

#### LOW VISION WITH HIGH TENSION.

Miss M. P., age 16.—November 26, 1911.—“Near-sighted” and suffering from headaches. Attending boarding-school in St. Louis. O.D., V 16/38; O.S., V 16/24. Ophthalmoscope shows great pallor of disc but not actual atrophy. Pupils large. Tonometer: O.D., 23 m.m.; O.S., 19 m.m. Fields slightly contracted. Used pilocarpin 1 per cent. and prescribed the same to be used three times a day. Two days later, O.D., V 16/24; O.S., V 16/24. Used eserin  $\frac{1}{2}$  per cent.

December 2, 1911 (one week later).—Headaches were gone. Fields normal. O.D., V 16/24; O.S., V 16/24. Tonometer: O.D. or O.S., 15 m.m.

In the study of secondary glaucoma, we must be prepared for apparent contradictions in the findings. Secondary glaucoma is

that form in which the cause for the increase in intraocular pressure can be located in previous or co-existent ocular disease. It is often of traumatic origin. It is a well-known fact that secondary glaucoma, when caused by occlusion of the drainage system of the eye through inflammatory conditions, involving the uveal tract to a greater or less extent, is frequently benefitted by the use of atropine, which intercepts the complete occlusion of the pupil and reduces the congestion of the uveal tract sufficiently to relieve the patient of his suffering and actually to lessen the intraocular tension, even though it tends to block the spaces of Fontana leading to the canal of Schlemm. We may reasonably expect therefore, as is shown in the clinical histories of the following cases, a variability in the record of the intraocular tension following the use of atropine. If the dilatation of the pupil and the retardation of the drainage through the canal of Schlemm occurs before the atropine has reduced the inflammatory congestion of the uveal tract so that the out-flow is retarded before the in-flow is checked, we may expect to get a rise of pressure followed, as the continuous effect of the atropine is exerted upon the ciliary body and iris, by a reduction in the tension.

Miss S., age 25. August 19, 1912.—Discussion of soft cataractous lens O. S.; since that time fairly rapid solution of the broken down lens substance has been going on, some of the fragments occupying nearly half of the anterior chamber at times. With the finger no difference in the intraocular pressure was noticeable. A measurement with the tonometer was made October 3rd, merely to determine whether or not the seeming equality in tension was actually present. It showed, O.D., 14 m.m.; O.S., 21 m.m. Full dilatation was being maintained by atropin with cocaine solution used four or five times a day. Immediately after the measurement a drop of the solution was used. One hour later, O.S., 21 m.m. (same as before).

#### SECONDARY GLAUCOMA, PRESSURE VARIABLE.

H. P. K., age 42. May 27, 1912.—O.D., cataract after blow about thirty years ago; pain and ciliary injection O.D. O.D., V= acute perception of light. Projection imperfect. O.S., V 16/12+. Used atropin and cocaine solution with relief from pain, after which tonometer: O.D., 15 m.m.

June 11, 1912.—Pain returned three days ago. Tonometer: O.D., 43 m.m.

June 24, 1912.—Resumed atropin and cocaine solution; no pain; good dilatation. Tonometer: O.D., 15 m.m.

July 1, 1912.—O.D., 15 m.m. Atropin stopped.

September 17, 1912.—O.D., 25 m.m. Blood pressure 140. Used atropin and cocaine. One hour later, O.D., 25 m.m.

September 18, 1912.—O.D., 13 m.m.

September 19, 1912.—O.D., 40 m.m. Used atropin and cocaine. Three-quarters hour later, O.D., 47 m.m.

September 20, 1912.—O.D., 25 m.m. Atropin and cocaine continued.

September 23, 1912.—O.D., 20 m.m. Used atropin and cocaine. One hour later, O.D., 13 m.m.

Also, where there is serious disorganization going on in an injured eye, we may have rise of tension due to the hyperæmia accompanying the inflammatory reaction. In these cases also, the effect of atropine is beneficial through the control of the hyperæmia in the iris and ciliary body. After a sufficient time has elapsed, these cases may go into a state of hypotension due to the shrinking of the interior of the globe consequent upon the fibrinous exudates thrown out during the active inflammatory stage.

#### SECONDARY GLAUCOMA FOLLOWED BY HYPOTENSION.

J. B., age 45. O.S., perforating injury by large steel fragment 25 years ago. O.S., V=no perception of light. Severe pain. Occlusion of pupil; anterior chamber almost obliterated; use of atropin (1 per cent.). Cocaine (3 per cent.) (oil) solution followed by relief from pain.

November 29, 1911.—O.S., 90 m.m. (stony hardness to finger). Treatment atropin and cocaine (oil) every two hours.

September 10, 1912 (ten months later).—O.S., 22 m.m.

Some cases of secondary glaucoma may develop subsequently to inflammatory conditions in which atropine has been of great service, but may require that the atropine be suspended and the eserine substituted for it. Tonometry furnishes us the means of measuring the effect of these drugs so accurately as to be an invaluable guide in their administration. The following case illustrates this rather strikingly.

#### SECONDARY GLAUCOMA AFTER TUBERCULAR KERATITIS AND UVEITIS.

Miss L. L., age 29, Nov. 10, 1911.—Suffers from pain in O.D. often accompanied by "roughness of cornea". Vision in O.D. is reduced to counting of fingers at one foot due to deep and ex-

tensive corneal opacities. O S., Vision=16/30 with correction; also has a few corneal nebulosities, probably due to phlyctænular keratitis in early childhood. Has been under observation more or less for five years. Previously the use of atropin has been necessary for relief from pain. This time pain was increased during day following its use.

Next morning the tonometer showed O.D., 33 m.m. Believing this due to secondary glaucoma from iritic adhesions the atropin was repeated, after which the tonometer showed O.D., 43 m.m. Eserin  $\frac{1}{2}$  per cent. solution (in oil) was used repeatedly at once, and on the following day without change in the tension until the third day, when it fell to 33 m.m. On the fifth day it had fallen to 25 m.m. The patient being by this time quite comfortable. The eserin solution was continued three or four times a day and by the seventh day tension O.D. was down to 10 m.m. Eserin was thereafter used less frequently, and on the eighth day the tension was 12 m.m. and O.D. vision=3/150. She then left for her home in the northern part of the state, continuing to use eserin  $\frac{1}{2}$  per cent. solution in O.D. twice daily.

March 7, 1912 (three months later), on her return.—Tonometer: O.D., 21 m.m.; O.S., 8 m.m. Eserin was omitted. On the following day O.D., 24 m.m. (an increase of 3 m.m. at once). Eserin was used, and on the following day, O.D., 22 m.m. Blood pressure 100. Eserin again omitted for two days, after which O.D., 35 m.m. Eserin oil solution 1/240 used, and 1 $\frac{1}{2}$  hour later O.D., 22 m.m. Resumed eserin twice daily, and in two days O.D., 15 m.m. Vision was retained at O.D., 3/150; O.S., 16/30.

Patient removed to the state of Washington, but reports by letter show good effect from the continued use of the eserin solution.

An iridectomy might have been done here with good effect; but we must consider the possibility of a recurrence of the tuberculous process because encapsulated nodules in the iris might be torn open, as reported by Stock. Also, the use of eserin seemed to afford perfect control with the maintenance of improved vision and perfect comfort, so no operative interference was suggested.

#### SECONDARY GLAUCOMA DUE TO INTRAOCULAR GROWTHS.

The use of the tonometer may be a factor in the diagnosis by distinguishing between similar detachment of the retina, in which there is invariably a reduction of the tension and detachment due

to a new growth in which there may be a rise above the normal tension. This is not a constant symptom of a new growth. Only two days ago, I removed an eye in a woman aged sixty-five, on account of what is probably a sarcoma of the choroid, the development of which I have observed for two months, during which time it more than doubled itself in thickness and the area involved, but which did not show any increase in the tension over the unaffected eye. The following history shows that marked elevation in the tension does at times accompany the development of these growths.

#### SARCOMA OF THE CILIARY BODY.

Mrs. R. D., aged 67. May 4, 1912.—Right eye containing a neoplasm—probably sarcoma; beginning in the ciliary body and now visible in the posterior chamber through the pupil on direct examination. The tonometer showed O.D., 43 m.m.; O.S., 15 m.m. (unaffected eye). Thus strongly confirming the diagnosis of an intraocular growth. Patient indignantly declined the proposal of enucleation.

September 19, 1912.—Returns, and after consultation desires enucleation. Two days previous to the enucleation tonometer measurements were O.D., 65 m.m. (increased 22 m.m.); O.S., 15 m.m. (same as four months ago). Vision in the right eye had fallen from 16/48 to 16/150 during the interval.

Much has been written concerning the effects of mydriatics on the intraocular tension. Careful measurements with the tonometer seem to show that no considerable rise in the tension is likely to accompany the use of mydriatics in eyes not otherwise diseased. The following two records, and one above recorded among the cases where cocaine was applied to Meckel's ganglion, show that there is an inequality in the reaction of the eyes of different individuals to atropine, just as there is a difference in the response of different individuals in general systemic medication.

#### EFFECT OF ATROPIN, CASE 2.

Miss M. L., age 22. September 17, 1912.—O.D. or O.S., with +.25 Cyl. Ax. Vert'l, V 16/12+. Tonometer: O.D., O.S., 12 m.m. Used homatropin solution 2 per cent. right and left. One hour later O.D., O.S., 12.5 m.m. Used atropin and cocaine solution. One hour later O.D., O.S., 12.5 m.m. Blood pressure 135.

September 18, 1912 (following day).—Full dilatation—nothing used. Tonometer: O.D., O.S., 12 m.m.

September 19, 1912.—Tonometer: O.D., O.S., 11 m.m. Used atropin and cocaine solution. One hour later O.D., O.S., 12.5 m.m. With correction V=16/12.

EFFECT OF ATROPIN ON INTRAOULAR TENSION, CASE 3.

Miss L. M. H., age 20. February 10, 1911.—With —.5 Sph., O.D., V 16/10; with —.25 Cyl. Ax. horz'l, O.S., V 16/10. Correction uncertain.

September 24, 1912.—Tonometer: O.D., 15 m.m.; O.S., 12 m.m. Used homatropin solution 1/60 right and left. One hour later good dilatation. Tonometer: O.D., 12 m.m.; O.S., 12 m.m. Used atropin (1 per cent.) and cocaine (3 per cent.) solution (in oil) right and left. One hour later O.D., 15 m.m.; O.S., 12 m.m.

September 25, 1912.—O.D., 17.5 m.m.; O.S., 21 m.m. Used atropin solution as above right and left. One hour later, O.D., 15 m.m.; O.S., 15 m.m.

September 26, 1912.—O.D., 21 m.m.; O.S., 17.5 m.m.

We are accustomed to think of measurements of intraocular tension as having reference almost entirely to hypertension. Schirmer points out that it was due to imperfect methods of examination; that we have not known ere this that lessened tension (hypotonus) is a constant symptom in acute as well as chronic cyclitis. My own measurements, with a few exceptions in which there were probably other complications, confirm this observation.

RETINAL DETACHMENT FOLLOWING ERYSIPelas.

Sergt. J. D. F., age 25. About a year after a severe attack of facial erysipelas with much swelling, especially about the eyes (right more than left), with delirium and some meningeal symptoms, patient suddenly found he could not see with right eye. Ophthalmoscopic examination showed extensive detachment of the retina with fibrous bands in the vitreous and a few disseminated chorioidal scars. O.D., V 8/150; O.S., V 16/12.

As he had no defect in vision on enlistment two years ago, it seems reasonable to look for the cause of the detachment in this attack of erysipelas. For some reason which I have not yet been able to make out, this patient on several occasions showed hypertension. The high general blood pressure and the patient's flushed appearance might indicate that he had taken some special stimulant. To my knowledge this effect of alcoholic stimulants or drug habits on intraocular tension, as measured by this instrument, has not been reported.

September 11, 1912 (in bed just after pressure bandage at barracks).—Tonometer: O.D., 10 m.m.; O.S., 18 m.m.

September 13, 1912.—O.D., 18 m.m.; O.S., 25 m.m. Blood pressure 155.

September 19, 1912.—O.D., 12 m.m.; O.S., 17 m.m.

September 28, 1912.—O.D., 30 m.m.; O.S., 35 m.m.

#### DIMINISHED TENSION IN IRRITIS.

E. H. S., age 25. September 16, 1912.—Suffering from specific iritis O.S., for three weeks. Good dilatation except single posterior synechia in upper nasal quadrant. Uses atropin and cocaine every three hours. Tonometer: O.D., 10 m.m.; O.S., 7 m.m.

September 20, 1912.—Tonometer: O.D., 10 m.m.; O.S., 8 m.m.

October 3, 1912.—Use of atropin discontinued. Pupil O.S. still dilated. O.D., 8 m.m.; O.S., 8 m.m. O.D., V 16/12+; O.S., V 16/12.

#### CENTRAL CHORIOIDITIS.

H. B. A., age 17. Central chorioiditis O.S., much swelling and retinal oedema, blurring of all fundus details. General and neurological examinations negative. Double sphenoidal suppuration—smears of pus showing no bacteria (tubercular). Tonometer: O.D., V 20/12; O.S., V 10/240.

September 10, 1912.—O.D., 13 m.m.; O.S., 10 m.m.

September 13, 1912.—O.D., 10 m.m.; O.S., 6 m.m. After cocaine 4 per cent. solution: O.D., 10 m.m.; O.S., 6 m.m.

zur Nedden has found tension decreased in phlyctenular inflammations, episcleral hyperæmia, and where a foreign body remained a long time upon the cornea, and concludes that subconjunctival congestion by derivative action on the intraocular vessels produces this effect.

#### SEVERE KERATITIS FASCICULARIS.

Miss A. B., age 25. September 24, 1912.—A severe keratitis fascicularis of some two or three months standing before she came to the Eye Clinic at O'Fallon Dispensary, Washington University Medical School. Leash of blood vessels extending to center of cornea from below. Much photophobia. Tonometer showed O.D.+ (unaffected eye), 15 m.m.; O.S. (inflamed eye), 13 m.m. Forty-five minutes after a drop of atropin and cocaine oil solution had been used in O.S. its tension was further reduced to 12 m.m.

On the strength of measurements showing that eserin strongly

reduces intraocular tension as measured by the tonometer, Kaz, of St. Petersburg, refers to a former report on the beneficial action of eserin in keratitis, believing the lessened tension on the cornea permits improved nutrition.

Subsequently, in the June number of the same Journal, Gunnufsen, an assistant of Schiötz, at Christiania, has reported that in severe ulcerative keratitis (*ulcus serpens*) more than 60 per cent. of the cases showed increased tension, and that in all cases which had previously been treated with atropin the tension was over 25 m.m. Only among these latter were three cases of dangerously high tension. He proposes the use of eserin in place of atropine even though it may be followed by the formation of a few adhesions of the iris. On the other hand, I have seen the tension lowered by atropine in superficial ulceration of the cornea. Gunnufsen suggests a base of crescentic outline as a substitute for the usual circular one to secure better measurement of tension in cases of corneal ulceration. It would seem that the distortion of the cornea in these cases would hardly allow of perfect accuracy and that the value of the measurements depended on successive results, whether with the circular or crescentic base, neither being wholly satisfactory, nor one much better than the other.

The following cases are here reported because of their individual peculiarities without reference to any general classification or conclusions.

#### PERFORATING TRAUMATISM WITH PERSISTENT MYDRIASIS.

Mr. A. N., age 23. August 30, 1912.—Perforating injury of the sclera temporal side 4 m.m. from limbus by a large fragment of iron. Cloudy vitreous and lens which cleared up after a week, when a chorioidal rupture near the temporal margin extending below the disc was visible. No atropin had been used in the injured eye for two weeks. O.D., pupil 6 m.m. in diameter; O.S., pupil 3 m.m. in diameter. Tonometer: O.D., O.S., 12 m.m. Pilocarpin 1 per cent. used O.D. After thirty minutes O.D. pupil 2 m.m. in diameter. Tonometer: O.D., 12 m.m.

Thus neither mydriasis nor myosis nor the stimulation of the ciliary muscle by pilocarpin showed any trace of effect on intraocular tension in this case.

#### DOUBLE OPTIC ATROPHY.

Mrs. R. J., age 19.—Atrophy probably the result of double sphenoidal sinusitis. Tonometer: O.D., 12 m.m.; O.S., 12 m.m.

MEDICO-LEGAL IMPORTANCE OF ACCURATE TONOMETRY IN  
GLAUCOMA.

R. F. R., age 65.—Double glaucoma.

August 16, 1911.—O.D., V 20/19; O.S., acute perception of light—sometimes motion of hands at 6 inches. Tonometer: O.D., 33 m.m.; O.S., 50 m.m.

October 21, 1911.—O.D., 45 m.m.; O.S., 70 m.m.

November 21, 1911.—O.D., 55 m.m.; O.S., 75 m.m.

December 29, 1911.—Atropin and cocaine oil solution used by his attending physician by mistake instead of eserin solution.

When he was brought to me the pupil of O.D., his better eye, was already quite large. As I had long urged an iridectomy in this case I now proceeded to operate at once, doing an iridectomy O.D. and merely a paracentesis and lavage of the anterior chamber of O.S. He made a good recovery and on January 24, 1912, tonometer: O.D., 19 m.m.; O.S., 55 m.m. O.D., V 20/30—20/19.

February 17, 1912.—O.D., 14 m.m.; O.S., 58 m.m.

These measurements were repeated by another oculist and as they show the patient's condition to be really better than before the mistake was made, they leave no basis for a claim against the attending physician on account of his error.

It is clear that direct evidence thus graphically recorded is of more value in the court room than the approximate recollection of feelings in index fingers of even an expert witness as to the degree of hardness or softness of an eye.

Aside from the minor points of interest in each case reported we may be permitted the following generally accepted conclusions:

That scrupulous accuracy in each first measurement is better than the general average of successive measurements if these show more than slight variations.

That careful control of results from medical or surgical treatment can be accomplished by the Schiötz tonometer or some instrument of its kind, better than by the fingers of the most skilled ophthalmologist.

That cases of glaucoma may require treatment while the intraocular tension is not greater than the "normal" of other individuals.

That successful treatment of such cases shows them to have a "normal" tension of much lower degree.

That comparative records of these cases with low tension can

not be made except by the aid of such an instrument for the accurate registration of tension.

That the instrument is not only essential in the treatment of glaucoma, but that its greatest usefulness may perhaps develop in the study of the etiology of this disease.

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#### SIGNIFICANCE OF THE GROUP OF HÆMOPHILIC BACILLI IN CONJUNCTIVITIS, ESPECIALLY IN THAT OF TRACHOMA.

Anna Wessels Williams (*N. Y. Med. Jour.*, March 16, 1912) says that during the past year and a half ten workers in the New York Health Department have been studying trachoma and allied conditions from all standpoints, but particularly from that of the public school children of New York City. Cultures from practically all the acute papillary trachoma cases have shown the presence of a tiny bacillus which has *morphology and staining characteristics very similar to those of some of the trachoma inclusions*. This leads them to conclude that "bacillus and inclusion are probably identical in papillary trachoma, and hence that the bacillus is probably the cause of the disease." She says that this hypothesis explains many other hitherto unexplainable phenomena of this disease: 1, Its irregular onset; 2, its insidious course; 3, its variable contagiousness with its exacerbations of secretion; 4, the continued presence of trachoma in certain districts where helping causes are present. With this for a working hypothesis, practically all cases of secreting conjunctivitis, however mild, should be treated and watched until all secretion has ceased, thus eliminating dangerous carriers, as organisms of this type presumably lose their virulence quickly under favorable conditions.

## MEDICAL SOCIETIES

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### OPHTHALMIC SECTION, ST. LOUIS MEDICAL SOCIETY.

March 6, 1912.

Dr. J. Green, Jr., in the Chair.

*Tubercular Choroiditis of the Macula.*—By Frederick Parker, M.D., St. Louis, Mo.

Miss F. Z., age 16, bundle wrapper, was admitted to the Washington University clinic on January 2nd, 1912, with the following history: Father died in October, 1911, from tuberculosis; lost two brothers when quite small,—cause unknown. Mother still living. Grandfather on mother's side died from tuberculosis eight years ago. Rest of family, consisting of two brothers, in good health. Miss Z. claimed always to have had good health, although she was never robust. Present weight 103 pounds. Has suffered from headache since before she quit school, which was two years ago. Since the last of November or the first of December, 1911, noticed blurring of right eye while reading. This has persisted, there having been no apparent change in vision in left. Does not notice the left any more blurred now than always, although vision is only 15/60, while with right she can only count fingers at four feet. Ophthalmoscopic examination of right eye; vitreous body cloudy, disc margin blurred, vessels can scarcely be made out on disc and appear to view only quite a distance from it. In the macular region is a white infiltrate about the size of the disc, oval in shape, with long axis vertical. Towards the periphery the vessels become plainer. Left eye, disc hyperæmic and margins slightly washed; macula apparently normal. Refraction slightly plus. Was referred to medical clinic. Von Pirquet positive; X-ray showed marked hilus infiltration. Is now receiving tuberculin injections three times a week and is improving.

#### DISCUSSION.

Dr. W. E. Shahan: I would like to know on what definite grounds the differential diagnosis was made in the case of tuberculous choroiditis. As to the case of retinal separation, I had

the opportunity of observing a case similar to this one. In the beginning it presented a sharply defined knob-like protrusion into the vitreous body from the temporal side, nothing from the lower part of the fundus, and the question arose as to whether it was a tumor or a simple separation of the retina. There was no pain, increase in tension or other pathological sign about the eye. The diagnosis could not be made at the time because the thing was so rounded out and so dense looking that it appeared to be solid. After the passing of some weeks, however, the knob began to get smaller and another one arose in the lower part of the fundus and ultimately the whole of the projection into the vitreous body settled down to the bottom of the fundus as a typical separation of the retina with undulating surface. This case looks to me like a simple separation of the retina. I do not think there would be any objection, if it came to a question of enucleation, to introducing a hypodermic syringe and getting out some of the fluid that may be causing the tumor-like appearance. This is a routine procedure in some clinics. The examination of the fluid removed would help to determine, to a certain extent, its character.

Dr. Woodruff: I would like to ask if any one noticed a fluctuation in the mass.

Dr. Ewing: I saw the case at the clinic and to me there is a positive fluctuation on both sides of the tumor. The suspicious thing about the appearance is that to the nasal side you can follow the separation by the ordinary cloudy reflex that goes with this condition. Then comes the dark mass which begins at the nasal side of the disk and extends to the temporal side of the fundus. I have seen several extensive separations of the retina in which the separated portion was black or dark brown and there were later no bad results. For this reason I would delay in coming to a positive diagnosis.

Dr. Hooss: The point of interest to me, is the fact that there is normal tension which might point against the intraocular growth. If this be a detachment of the retina, it seems that the refraction would not be hypermetropic. Also, there is no history of injury. I think these are interesting points to be considered.

Dr. Green: In the patient with detachment of the retina, I would suggest that transillumination might clear up the mystery. I should like to ask if there was a suspicion of cysticercus in

anybody's mind? Possibly the withdrawal of the subretinal fluid might clear up the diagnosis in the event of cysticercus. There has recently been discovered a blood test for cysticercus which has been applied to a few cases abroad, but the results have been so unreliable that the test cannot at present be regarded as of much help in diagnosis.

Dr. Shahan: I do not think the Von Pirquet test alone is enough upon which to base a diagnosis. It is not entirely dependable, especially in patients of her age. I would like to ask the doctor if there were any other signs of tuberculosis.

Dr. Green: I agree with Dr. Shahan. A positive Von Pirquet does not warrant a diagnosis of tuberculosis in an individual of this age, 16. The more I see of this type of choroiditis, the more I am convinced that tuberculosis is frequently the cause; but I will not venture on a positive diagnosis unless I get a reaction, local and general, to the diagnostic injection of tuberculin. Two or three cases have recently impressed me with the value of carrying out systematically this procedure: no reaction occurring after the first two injections, (respectively 1 mgm. and 3 mgm.), but a positive reaction showing up after 10 mg. injection. For diagnosis, not only the general, but the local reaction is necessary.

Dr. Ewing: I saw this case on the second day. It was then in its incipiency and, judging from the clinical picture it presented, there was no question as to the cause of the swelling. The patient was immediately put in the hands of the Washington University Medical clinic service. As everything there is managed with the greatest care, I have no doubt but that she has received correct treatment in every respect. Another thing, the disease is subsiding and the patient is steadily improving on the regular tuberculin treatment.

Dr. Woodruff: In addition to what Dr. Ewing has just said, the patient was sent back from the medical clinic at Washington University and there was no question about the diagnosis of tuberculosis. The family history is positive, and the typical appearance and the general examination show the presence of tuberculosis. I think we have taken the position that it is tuberculosis on good grounds and there is not much room for doubt as to the diagnosis, i.e., a tubercular choroiditis.

Dr. Green: I fear my position has been mistaken. I agree with the diagnosis of tuberculosis of the choroid, on clinical grounds, in the patient presented. Too much stress, however,

has been laid on the fact that the Von Pirquet was positive as though that fact was all sufficient to clinch the diagnosis. Clinicians are now in general agreement that the sole reliable test of tuberculosis in adults is a positive, general and local reaction to diagnostic injections to tuberculin. Where it is possible to make a positive differential diagnosis as between a tuberculosis and a syphilitic process, we are derelict in our duty to the patient if we do not exhaust every diagnostic means to determine the exact nature of his trouble. This is particularly true in ocular tuberculosis, where tuberculin therapy has had some of its greatest triumphs.

Dr. Hooss: I would like to know if it is perfectly safe, i.e., the technique in using tuberculin as 3 mm., 5 mm., or 10 mm. at so short intervals. Dr. Green replied that it is perfectly safe.

Dr. Shahan: As to the use and proper doses of tuberculin, there has been some disagreement. Some rather disastrous results have been reported following large initial doses so that in such cases as I have had anything to say about, I insist on the internist beginning with extremely small doses. One ten-millionth of a milligram is enough to start with and this should be increased so gradually as to produce a minimal general and local reaction, or possibly none at all.

Dr. Parker, in closing: In answer to Dr. Shahan's question in the differential diagnosis, this man presented all the picture of a luetic. He had the rash, also had the local lesion, and to my mind there was no question about it. As for the tuberculous patient, as I said, we had a Von Pirquet made which was positive, and she has been put on tuberculin and has been gaining ever since. No Wassermann was made, but I suppose it should have been made. She is now under the care of Doctor Fischel.

*An Artificial Eye for Laboratory Use.*—By James Moores Ball,  
M.D.

This artificial eye is for use in the physiologic laboratory and is designed to show the effect of lenses upon rays of light. The idea of demonstrating refraction in this way is not new. You are doubtless familiar with the Kühne eye consisting of a water tank with glass sides. A curved surface at one end represents the cornea, back of which is suspended a double convex lens—representing the crystalline body. There is a movable screen for the retina, an iris-diaphragm, a cap to neutralize the curvature of the cornea and a cylindric lens to represent astigmatism.

While the Kühne eye is not inexpensive, the chief objection to it lies in its liability to get out of order. The adjustable crystalline lens and iris diaphragm are suspended in water and soon deteriorate.

The apparatus which is here shown consists of a vertical tube to contain the luminous body, a horizontal tube to hold the lenses, and an ordinary aquarium tank. The vertical tube presents a bulging area in which is placed a simple concave mirror made of tin. The light is placed at the principal focal point of the mirror. The effect of this mirror is to make rays of light parallel. The horizontal tube is cut length-wise and its parts work on hinges. Attached to the lower segment of this tube is a rod on which the lens-carriers slide. These carriers and the horizontal tube have been made of the proper size to permit the use of lenses of the ordinary trial case. The tank is filled with water to which a few drops of fluorescein or of creolin should be added, in order that we may trace the rays. The retina is represented by a tin fundus on which, if you wish, a macula and nerve-head can be painted. Several supports for lenses to be suspended in the tank, are also provided. To increase the efficiency of the apparatus an iris diaphragm should be added. This can be placed at the distal end of the horizontal tube. With this apparatus one can show the action of spheric and cylindric lenses, the effect of prisms, the state of refraction in emmetropia, hypermetropia, myopia and astigmatism, probably with better results than can be had from the use of diagrams alone. If desired, the tank can be used as a smoke box such as we find in the artificial eye described by W. T. Porter and made by the Harvard Apparatus Company.

#### DISCUSSION.

Dr. Green: I should like to ask Dr. Ball whether his idea of the water box is original or whether it was adopted from some other schematic eye. As I understand, the Porter eye has a smoke box.

Dr. Ball: The Kühne eye has a water box, so the idea is not original.

*Demonstration of Patient.*—By Dr. Hardy.

This case is somewhat of a companion to the first one of Dr. Parker's. It is up chiefly for diagnosis. He gives a history of having become suddenly blind in the lower field, two years ago, and then later in the whole field. He has central vision of

direction of hand movements at six feet, but to the temporal side he has hand movements at two feet. Several gentlemen have looked at it and have been unable to make an exact diagnosis as to causation. For that reason I thought it worth while to present to the Society to-night. The case is one of detached retina.

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OPHTHALMOLOGICAL SOCIETY  
OF THE UNITED KINGDOM.

Thursday, June 13th, 1912.

Mr. J. B. Lawford, F.R.C.S., President, in the Chair.

Mr. Nettleship explained the pedigree of four families containing color-blind members with certain unusual facts connected with them. They all contained one or more color-blind females. According to the Mendelian scheme of inheritance where color-blindness is found in a female it is to be expected that her father will have been color-blind and that if she has sons all of them will be color-blind. A congenital deformity, crooking of the little finger occurred in two of the color-blinds and one of the normals in direct descent. A similar condition he had noticed in some other members he had previously found in another pedigree of color-blindness which he had published. Two of the pedigrees showed a pair of female twins in each of which one was color-blind and the other was not. He mentioned that the only other recorded case was one by Reber of male twins. In one of his own cases the twins were probably "similar" for they had a common placenta and both children were almost exactly alike. The tests he used for the detection of the color defect were wools, Nagel's test and the spectroscope. In the other pair of twins the resemblance to each other was not so marked and it is very doubtful if these were "identical" twins. He discussed some possible explanation to account for these cases. Various other points in the pedigrees were mentioned and discussed. Mr. Nettleship also read an account of a pedigree of color-blindness in a family worked out by Mr. C. H. Usher (Aberdeen). The pedigree showed the union of two unrelated stocks both containing cases of color-blindness. A color-blind male married a normal female who presumably carried the condition. Her family consisted of three sons, two of whom

were color-blind, and five daughters who were all healthy and who showed no defect in this respect. Mr. Nettleship also read a paper on Pedigree of Hereditary Cataract part of which had been previously published in the Transactions of the Society, Vol. 29. As the pedigree had been more fully worked out the whole was republished. There were 17 cases of cataract occurring of which nine were males and eight females, while others showed vacuoles in the lens. The descent was uninterrupted from parent to child in every case so that it behaved as a Mendelian dominant, the cataract never appeared in the issue of a normal member of the stock. It commenced in a well defined posterior polar opacity at various ages between childhood and middle life, and became more or less complete if left alone; some had been needled at an early age. Some of the results were good but some left dense capsular opacities. "Anticipation" or "ante-dating" had not occurred with regularity.

Dr. Edridge Green spoke of the greater prevalence of color-blindness among women than was formerly thought, and proceeded to show how very defective Holmgren's color-vision testing was in detecting color-blind persons. He strongly advocated the lantern test. Mr. Mould referred to an interesting case of his own of family color-blindness.

Mr. Malcolm L. Hepburn read a paper on "Inflammatory and Vascular Diseases of the Choroid" and showed diagrams and drawings to illustrate it. He discussed the present method of classifying diseases of the choroid and gave a general description of changes which occurred in all inflammatory foci in the choroid. He explained pathologically how loss of function of the retina was brought about, and suggested an anatomical classification of the cases. He described the following clinical varieties of old choroiditis and the effect that each form had on the visual function: Diffuse, deep patchy, superficial patchy, macular choroiditis. He discussed the following vascular diseases of the retina: Retinitis pigmentosa, hemorrhagic retinitis, emboli, thrombosis, endarteritis, and degeneration. He finally adduced evidence in support of a localized choroidal vascular supply from cases shown and described.

Thursday, July 11th, 1912.

Mr. J. B. Lawford, F.R.C.S., President, in the Chair.

Mr. W. H. Jessop demonstrated Professor Gullstrand's ophthalmoscope, for monocular and binocular examination of the *fundus oculi*. Mr. Treacher Collins showed a case in which an intra-dural tumor of the optic nerve was removed with retention of the eyeball five-and-a-half years ago. The case, he said, showed the value of retaining the eyeball; there was good movement of the eyeball, and it was altogether better than an artificial eye. It also showed that some tumors were not very malignant in character. Though he did not get all the tumor away, there had been no recurrence. Mr. W. G. Laws showed a case of detachment of the retina, with cyst-like protrusion. There was no suspicion of cysticercus. Mr. P. C. Bardsley showed an instrument which he called by the name sclerotome, and the object of which was to do a trephine operation in one stage. With this instrument there was no danger of losing the disc of sclerotic within the anterior chamber on the completion of trephining.

A paper was read by Messrs. Brooksbank James and Stroud Horsford on "Operative Treatment of Glaucoma." Reference was made to a note in the Transactions of the Society of October, 1909, in which Mr. James described a method of operating upon cases of glaucoma by cutting through the sclera from without, after having turned down a preliminary conjunctival flap to cover over the linear wound. Since then the operation had been somewhat elaborated by turning out a piece of sclera by the following method. The conjunctiva having been made anaesthetic, and a few drops of adrenaline solution instilled, a large conjunctival flap was turned downwards to the corneal margin. All further bleeding was now stopped by adrenalin. An incision was next made at the limbus, concentric with the corneal margin, by cutting with the edge of a Graefe knife near its tip, so that the lips of the wound were perpendicular. The paring was proceeded with until a fair depth of wound had been attained. A small puncture was then made, and the aqueous allowed to evacuate itself very slowly. A blunt-pointed Stilling knife was now inserted into this opening, and the wound enlarged throughout its extent. A moderately large iridectomy was then made in the usual way. One then proceeded to turn

out a piece of sclera from the upper lip or the angles of the wound, endeavoring to ensure that some of the lining membrane was attached to its under surface. This was laid flat on the surface of the adjoining sclera, and held in position by the conjunctival flap being stroked over its surface. The special points in the operation were : (1) the fact that the edges of the scleral incision were perpendicular, not slanting. (2) It would be noticed that the iris fell backwards much more readily than in an ordinary iridectomy, and did not require the introduction of another instrument into the eyeball to replace it. (3) The scleral flap could be cut by one of two methods. In some of the cases this was done by means of a punch. This, however, was somewhat uncertain, and occasionally punched a piece of sclera clean out, which was not desirable. (4) Another method was to turn outwards by means of scissors or knife a strip from one or both angles of the wound. If this plan were adopted, it was better to outline the strip by marking out its limits almost through the whole thickness of the sclera prior to opening the anterior chamber, as the relaxed state of the tissues when the aqueous had escaped, rendered the proceedings more difficult. Mr. Horsford said he had carried out the method exactly as described in all his cases of glaucoma except one, and in that he did a peripheral iridectomy only. Whatever method was employed, there was a predilection on the part of the sclera to close up. Ten out of thirty-eight cases so treated closed up. Of the 38, 28 leaked by first intention, and 8 of the remaining 10 leaked on second intention. The operation was simple.

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## ABSTRACTS FROM MEDICAL LITERATURE.

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### MANAGEMENT OF SQUINT IN CHILDREN.

C. W. Le Fever (*American Jour. of Dis. of Children*, February, 1912) emphasizes the great importance of those who have the oversight of children understanding that squint can be cured by nonoperative measures. He says the cure depends upon the *early* institution of the proper measures and the careful carrying out of the same. Three persons share the responsibility for permitting children to grow up with crossed eyes and loss of the use of one eye: First, the parents; second, the pediatrician or

general practitioner; third, the oculist. Treatment is considered under five heads: 1. Correction of the hypermetropia. 2. The use of atropin only when glasses are out of the question, and until such a time as the child may be "glossed". 3. Cure of the amblyopia. 4. The re-establishment of the fusion sense. 5. The use of operative measures only as a last resort, which will rarely be necessary if the child is properly managed from the beginning of the squint.

#### THE CAUSE OF MYOPIA

W. H. Bates (*N. Y. Med. Jour.*, March 16, 1912) says: "Functional myopia is an early stage of myopia with elongation of the eyeball. It is produced by muscular action, which alters the curvature of the crystalline lens, modifies the convexity of the cornea, or produces an elongation of the eyeball. Voluntary functional myopia may be produced by efforts to see distant objects, in children, elderly people, cases in which accommodation is apparently paralyzed by atropin, and in aphakia after cataract extraction. That muscular action can produce functional myopia is shown by the fact that many cases of voluntary functional myopia manifest a convergent, divergent, or vertical squint. Also, operations on the eye muscles have benefited functional myopia. His experience leads him to believe that atropin does not always relax the near focus nor relieve functional myopia. Studying a large number of eyes, he found that "an unsuccessful effort of the normal eye to see accurately new, strange, or unfamiliar distant objects was always followed either by myopic astigmatism, usually,—compound myopic astigmatism, occasionally,—or simple myopia, infrequently. Mixed astigmatism was not observed." Some of the symptoms of efforts to see distant objects clearly, are,—partly closing the eyelids, or the reverse; staring; wrinkling of the skin of the forehead and eyelids; contortions of the facial muscles; inclinations of the head in various directions; tremor of the head; and movements of the eyeballs resembling nystagmus. The efforts are often so marked that one can generally tell from this alone that the vision is defective. Reference is made to the fact that wild birds have unusually good vision, while in captivity they acquire myopia; also that uncivilized people usually have good sight, but acquire myopia after living in civilized communities a while; and the further fact that children in the first year of school have normal vision while later they acquire myopia. In explanation Bates says: "The cause of myopia is the same in birds, the lower animals,

uncivilized man, and school children. The uncivilized man is compelled to adjust his eyes for accurate distant vision, for protection against enemies, and in obtaining food. But, when living in civilized communities he is protected from enemies, his food is supplied, accurate distant vision is no longer necessary, he neglects to practice it, naturally loses it, and becomes myopic. Wild birds are compelled to adjust their eyes accurately for distant vision; but in captivity the necessity ceases, and because accurate distant vision is no longer required they neglect it and become myopic. School children do not need accurate adjustment of their eyes for distant vision. When they neglect to practice it they become myopic. To make the matter clearer: When the eyes are not accurately adjusted for distant vision they must obviously be adjusted for a near point and be functionally myopic." His conclusions are:

1. Myopia is not caused by efforts to read by a bad light.
2. The cause of myopia is an effort, usually unconscious, to see distant objects.

#### CASES OF NIGHT-BLINDNESS WITH PECULIAR CONJUNCTIVAL CHANGES IN CHILDREN.

S. Stephenson (*British Journal of Children's Diseases*, December, 1911), having examined 6,209 healthy children's eyes several years ago, found night-blindness present in 1.87 per cent. of that number. The condition is seldom found in winter but occurs most frequently during the summer and autumn months. "Bitot's syndrome" is a term sometimes applied to the fully developed symptom-complex which includes, first, changes in the ocular conjunctiva, and secondly, night-blindness. The conjunctival changes are, as a rule, found only in the interpalpebral zone and generally occur in both eyes, although sometimes to an unequal extent. The affected areas are more or less triangular and have the appearance as if covered with tiny particles of white foam. If this be wiped away it always reforms within twenty-four to thirty-six hours. The glistening plaques are very characteristic and the term epithelial xerosis is usually applied to the condition. The relationship between the conjunctival changes and night-blindness is not constant as either one may be present without the other. In 1895 Stephenson saw eighteen cases of xerosis of which 61 per cent. were more or less blind at night, while during 1896 and 1897, when nine cases of xerosis were respectively found, definite night-blindness was not found in any of the cases. He believes, however, that the relationship is much closer than is generally supposed.